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# The physical environment and major vegetation types of Sekhukhuneland, South Africa

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**A detailed account is given of the broad vegetation types of the Sekhukhuneland Centre of Plant Endemism. Phytosociological data from 415 sample plots were subjected to phytosociological classification using TWINSPAN. The resulting classification was further refined with table-sorting procedures based on the floristic-sociological approach to classification of vegetation. The analysis revealed six major vegetation types, interpreted as the *Acacia tortilis-Dichrostachys cinerea* Northern Dry Mixed Bushveld, the *Kirkia wilmsii-Terminalia prunioides* Closed Mountain Bushveld, the *Combretum hereroense-Grewia vernicosa* Open Mountain Bushveld, the *Hippobromus pauciflorus-Rhoicissus tridentata* Rock Outcrop Vegetation, the *Themeda triandra-Senecio microglossus* Cool Moist Grasslands and the *Fuirena pubescens-Schoenoplectus corymbosus* Wetland Vegetation. Each major vegetation type is described and its diagnostic species highlighted. The occurrence of rare and threatened plant species in each vegetation type is indicated.**

## Introduction

In view of the current focus on global biodiversity, it is not surprising that the identification of centres of plant diversity and endemism has become a matter of great urgency and importance (Myers 1988, Wilson 1992). The international Convention on Biological Diversity (CBD) has focused renewed attention on the rapid global loss and degradation of natural ecosystems (Convention on Biological Diversity 1994). Recently the World Conservation Union (IUCN) and World Wide Fund for Nature (WWF) recognised approximately 235 Centres of Plant Diversity worldwide, of which 84 are in Africa (Davis *et al.* 1994). These centres are endemic-rich botanical sites of global conservation significance. No fewer than 14 of these centres are located in southern Africa. However, many other centres of local importance have not yet been explored or investigated in great detail. The Sekhukhuneland Centre of Plant Endemism (SCPE) (Van Wyk and Van Wyk 1997, Siebert 1998) is such an area. It is a unique, serpentine-related, floristic region located in the Northern Province and Mpumalanga (Figure 1) on the ultramafic rocks of the Rustenburg Layered Suite of the Bushveld (Igneous) Complex (Siebert 1998).

Knowledge of the vegetation of the SCPE is limited, comprising mainly of the broad descriptions by Acocks (1953) and Low and Rebelo (1996). None of these two classifications are, however, based on phytosociological data. Acocks (1953) already mentioned the need for more detailed studies of the Mixed Bushveld in the Steelpoort region, the vegetation of which is representative of Sekhukhuneland. No detailed vegetation studies have been conducted in the SCPE and only a few unpublished phytosociological data sets are available, including surveys in the Maandagshoek region (Kritzinger 1992), and of Potlake Nature Reserve by M.M. Matthee during 1978.

Increasing pressure from the growing mining industry and the heavy demands on natural resources imposed by a burgeoning human population, calls for the wise future use and management of the SCPE's plant diversity. One of the main problems facing plant conservation in Sekhukhuneland is the lack of sound information on which to base conservation strategies. A baseline inventory of floristic data became necessary to supply authorities with the necessary information required to designate areas for the most appropriate forms of land-uses and to formulate management plans for the protection and sustainable use of the region's native plant resources. Hence, the primary motivation for this study stemmed from the urgent need to highlight those areas of prime botanical importance that is prone to rapid loss and degradation of natural ecosystems due to unplanned and uncontrolled development.

The principal aims of the reported vegetation survey were to present a description of the physical environment and a classification of the major vegetation types of the SCPE, as well as to compile a detailed floristic inventory. It is hoped that the information presented in this paper will aid consult-

ants and nature conservation agencies to conduct floristic surveys and to monitor vegetation in the region. This paper forms the basis for subsequent detailed accounts of the vegetation and flora of the SCPE.

## Study Area

The Sekhukhuneland Centre of Plant Endemism (SCPE) lies within, and across, the political borders of the Sekhukhuneland Magisterial District in the Republic of South Africa (Figure 1). It stretches from the Northern Province into the Mpumalanga Province, and include towns such as Roossenekal, Schoonoord, Steelpoort, Sekhukhune, Burgersfort and Mecklenburg.

The study area is situated between 24°15' and 25°30'S latitude, 29°30' and 30°30'E longitude. It is located to the west of the northeastern Drakensberg Escarpment where it encompasses approximately 4 000km$^2$. The layers of the Rustenburg Layered Suite of the eastern Bushveld Complex underlie the core area of the SCPE, with the Highveld Escarpment to the south, Strydpoort Mountains to the north, the Steenkampsberg and Drakensberg to the east, and the Springbok Flats to the west, bordering it.

### *Physical environment*

A literature survey was conducted to obtain existing information on the topography, geology, soils and climate (physical environment) of the SCPE (Erasmus 1985, Chief Director of Surveys and Mapping 1988, Visser *et al.* 1989, MacVicar *et al.* 1991). The information and maps (Figures 1–4) provided is of immense importance to consultants when conducting critical surveys of the flora of the region for environmental impact assessments.

### *Topography*

The topography of the SCPE is very heterogeneous and complex, a product of tectonic forces and magma surges 2 000 million years ago (Coetzee 1985), upon which the climate and erosive agents have promoted geomorphologic change (Marlow 1976).

Sekhukhuneland comprises a mountainous region with flat to undulating valleys (Figure 1). It is known for its parallel belts of rocky ridges and mountains, and its intervening, heavily eroded valleys. From the Steelpoort River valley, which lies at an altitude of 700m (one of the lowest points), the Leolo Mountains rise to 1 932m (the highest point) (Chief Director of Surveys and Mapping 1988).

Several small mountain ranges occur in the study area; of these the Leolo Mountains and the Thaba Sekhukhune Escarpment are the most diagnostic topographic features. Other prominent mountains of the region include Tauteshoogte (1 789m), Hoofstadkop (1 747m), Morone (1 520m), Morole (1 403m) and Phepane (1 436m).

Broad valleys traverse the SCPE and form part of the drainage basin of the Olifants River. The topography of Sekhukhuneland is the result of erosion over millions of years by the east-flowing Olifants River and its tributaries, after it had broken through the Great Escarpment (Partridge and Maud 1987). This basin with its mountains and valleys can thus be described as a 'lowveld' enclave within the 'highveld'. Several rivers drain the basin, and flow through valleys averaging an altitude of 750m. The largest rivers are the Olifants, Steelpoort, Lepellane, Moopetsi, Motse, Dwars and Klip.

### *Geology*

In contrast to most parts of the world, ultramafic rocks are plentiful in southern Africa (Kent 1980, Roberts and Proctor 1992). Most of the world's economically exploitable deposits of heavy metals are located in the ultramafic rocks of South Africa, more specifically in the Rustenburg Layered Suite of the Bushveld Complex (Coetzee 1985, Schürmann *et al.* 1998). Since surface outcrops of ultramafic rocks of the Rustenburg Layered Suite largely defines the area of the SCPE, the geology is important and discussed in some detail (Figure 2). The distribution of the endemics of the SCPE is positively correlated with the occurrence of ultramafic rock (Siebert *et al.* 2001).

The Bushveld Complex was formed during the Precambrian Erathem and represents the greatest mineral deposit event that has ever occurred on earth (Coetzee 1985). Before the formation of the Bushveld Complex, sedimentary rocks of the Transvaal Sequence covered the interior of what are today the northern Provinces of South Africa. Approximately 1 950Myr ago a series of magma surges resulted in the emplacement of lava into the interior of the Transvaal Sequence as a result of alternating stress and pressure conditions (Visser *et al.* 1989). When the lava crystallised it gave rise to different layers (Schürmann *et al.* 1998). The tremendous weight of the lava on the surface of the Transvaal Sequence resulted in its collapse. Layers of the Bushveld Complex and Transvaal Sequence were broken and exposed to the surface where it was weathered to its present state over millions of years.

The Rustenburg Layered Suite forms the outer limit of the Bushveld Complex, because it was deposited as the first (bottom) layers during the magma outflow (Keyser 1998, Schürmann *et al.* 1998). The Rustenburg Layered Suite, like the rest of the Bushveld Complex, comprises different layers. This characteristic igneous layering is the product of crystallisation differentiation during successive surges of magma (Visser *et al.* 1989). There are three major layers that were crystallised during its formation, namely the Upper Zone, the Main Zone and the Lower Zone (Kent 1980). The formation of the layers was dependent on the density of the minerals concerned (Kent 1980). When the lava reached the surface, the heavier metals sunk to the bottom where they crystallised first. The first layer that crystallised was the Lower Zone and is characterised by norite, bronzitite, dunite and serpentinised harzburgite as secondary layers. These layers contain main mineral components made up of elements such as Mg, Ni and Cr. The second saucer-shaped layer that crystallised was the Main Zone. It is characterised by four predominant secondary layers namely, norite, anorthosite, pyroxenite and gabbro. These layers are characterised by mineral components rich in Ca, Al, Ti and V. The Upper Zone is characterised by two main secondary layers, namely ferrogabbro

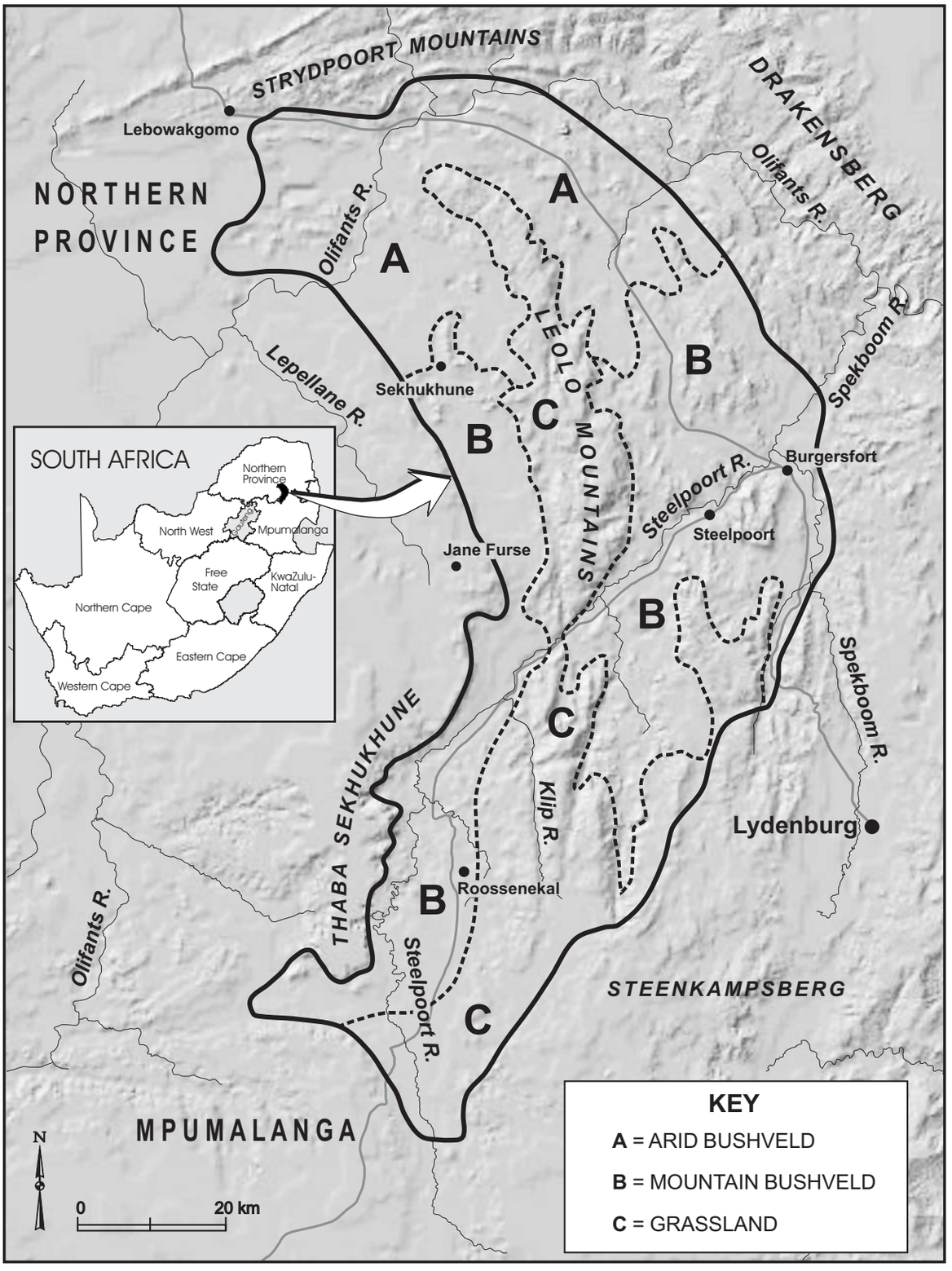


**Figure 1:** Location, topography and major floristic regions of the Sekhukhuneland Centre of Plant Endemism in the Northern Province and Mpumalanga, South Africa (based on Van Wyk and Van Wyk (1997), Siebert (1998), Van Wyk and Smith (2001))

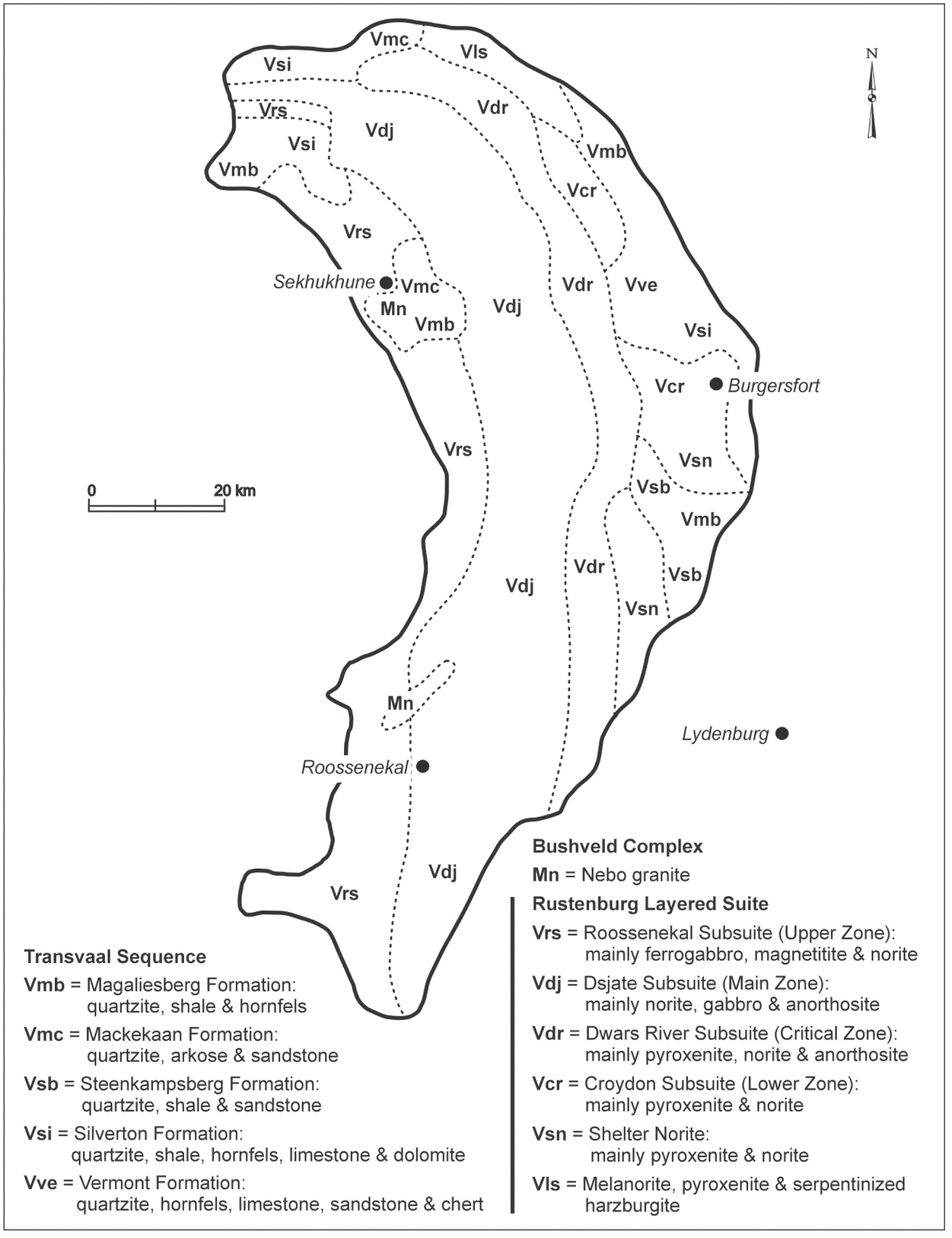


**Figure 2:** Major geological substrates of the Sekhukhuneland Centre of Plant Endemism (based on Marlow (1976), Kent (1980), Visser *et al.* (1989), Keyser (1998))

and ferrodiorite, and to a lesser degree, magnetitite. The main elements within the mineral components of these layers are Fe, Na, V and Ti. The crystallisation of chromites occurred between the Lower and Upper Zones and is referred to as the Critical Zone. The Critical Zone's secondary layers are mostly pyroxenite, norite, anorthosite, dunite and harzburgite. The main component of these layers contains rich quantities of Cr, Pt and Fe.

### *Soils*

Mother material from which soils developed in Sekhukhuneland are characterised by great variations in types, locality and abundance of elements (Marlow 1976). The abundance of the elements varies from one layer to another and therefore the type of heavy metal soil occurring in a specific region is a result of the specific exposed layer of the Rustenburg Layered Suite.

The heavy metals of the Rustenburg Layered Suite are associated with gangue minerals (Coetzee 1985). These gangues are basaltic rocks and are the intermediate form between serpentinite and granite (Wild 1978). Granite gives rise to 'normal' soils and serpentinite gives rise to 'toxic' metalliferous soils. Basalt contains higher concentrations of heavy metals than granite (Krauskopf 1967) and produces intermediate metalliferous soils (Wild 1978). Relatively high concentrations of heavy metals in the soils of Sekhukhuneland are therefore a consequence of its ultramafic origin.

Soil types of the SCPE (Figure 3) are characterised by clays. Ultramafic soils of the SCPE are mainly red or black montmorillonitic clays (Werger and Coetzee 1978). These soils are vertic to melanic A-horizons and are rich in smectite clay minerals and ions such as Ca, K, Na, and especially Mg (MacVicar *et al.* 1991). The soils are generally dark-coloured and occur in both upland and bottomland positions (Land Type Survey Staff 1987, 1988, 1989). Prominent soils of this type identified for the SCPE are Arcadia, Bonheim, Mayo, Milkwood and Steendal forms. Soils with ortic A-horizons and one of the following B-horizons, namely yellow apedale, red apedale, red structured, pedocutanic, neocutanic or lithocutanic, are also common in the SCPE. These include the following forms, namely Clovelly, Hutton, Shortlands, Valsrivier, Swartland, Oakleaf, Mispah and Glenrosa.

### *Climate*

Perhaps the most outstanding climatic feature of the SCPE is that it lies in the rainshadow of the northeastern Drakensberg Escarpment. Average annual rainfall for the SCPE is 578mm, but rainfall varies from as little as 400mm in some of the valleys, to an estimated 700mm on the Leolo Mountains and in the extreme south of the study area (Siebert 1998). Sekhukhuneland receives nearly half its rain (48%) between December and February (summer), an average total of 283mm for these three months (Erasmus 1985). Spring rains contribute 28% of the total rainfall in a single year.

The rainfall gradient extends from southeast to northwest (Siebert 1998). The western part of the study area receives less rain on average than the eastern parts. There is a gradual increase in rainfall from west to east, with a sharp increase in the east, on the border with the Drakensberg foothills. Fluctuations can be attributed to altitude. The northern parts of the study area are also drier than the south. The north-central part of the SCPE is the driest, with the average annual rainfall for the study area increasing towards Steenkampsberg in the south and the Strydpoort Mountains that form the northern extremity.

Extreme temperatures for the study area range from -4.5°C to 38°C. The daily average is approximately 18.5°C (Weather Bureau 1998). Temperature data also exhibit a set climatic pattern like that described for rainfall. Valleys have a subtropical climate with no frost in winter, whereas in the mountains the conditions become more temperate with frost in winter as altitude increases. The northern and western parts of the study area are on average warmer than the south and east. The northern and western parts have average daily temperatures of 28.3°C maximum and 7.2°C minimum. These temperatures compare well with those associated elsewhere with Mixed Bushveld (Van Rooyen and Bredenkamp 1996). Average daily temperatures of the southern and eastern regions are more temperate and below those expected for Mixed Bushveld.

Lower rainfall in the western and northern parts of the SCPE correlates with the warmer temperatures in these parts (Siebert 1998). Climatically the SCPE is an arid (karroid) subtropical (lowveld) enclave surrounded by areas that are temperate and much wetter (particularly towards the east and south) (Van Wyk and Smith 2001). The SCPE can be divided into three climatic regions (Figure 4), namely: (1) northern, moderately dry (350–450mm $yr^{-1}$) and warm (21–22°C daily average); (2) central region, intermediate, typically Mixed Bushveld rainfall (450–550mm $yr^{-1}$) and temperature averages (20°C); and (3) southern region, moderately wet (550–650mm $yr^{-1}$) and cool (18–19°C daily average)

## Methods

A data set of 415 relevés, containing a total of 1 010 taxa, was entered into a vegetation database created in TURBOVEG (Hennekens 1996a). As a first step the data was analysed with TWINSPAN procedures (Hill 1979) according to the procedure developed by Bredenkamp and Bezuidenhout (1995).

To reduce distortion of data in the numerical data set, cut levels were adjusted in MEGATAB (Hennekens 1996b) to alter the default definition of pseudospecies, which ensured less overweighing of dominants. A synoptic table was constructed to represent the major groups defined by the TWINSPAN classification (Table 1). Refinement of the synoptic table was done with Braun-Blanquet procedures according to the steps proposed by Behr and Bredenkamp (1988). The synoptic table contains the species in each of the identified major groups on constancy values of a 20% ordinal scale (I–V). Only species with a minimum constancy value of 20% (II), in any given major group, were included in the table. All the excluded taxa will be included into tables of subsequent papers that will focus on individual major groups.

Endemic, sub-endemic and Red Data List species/infra-

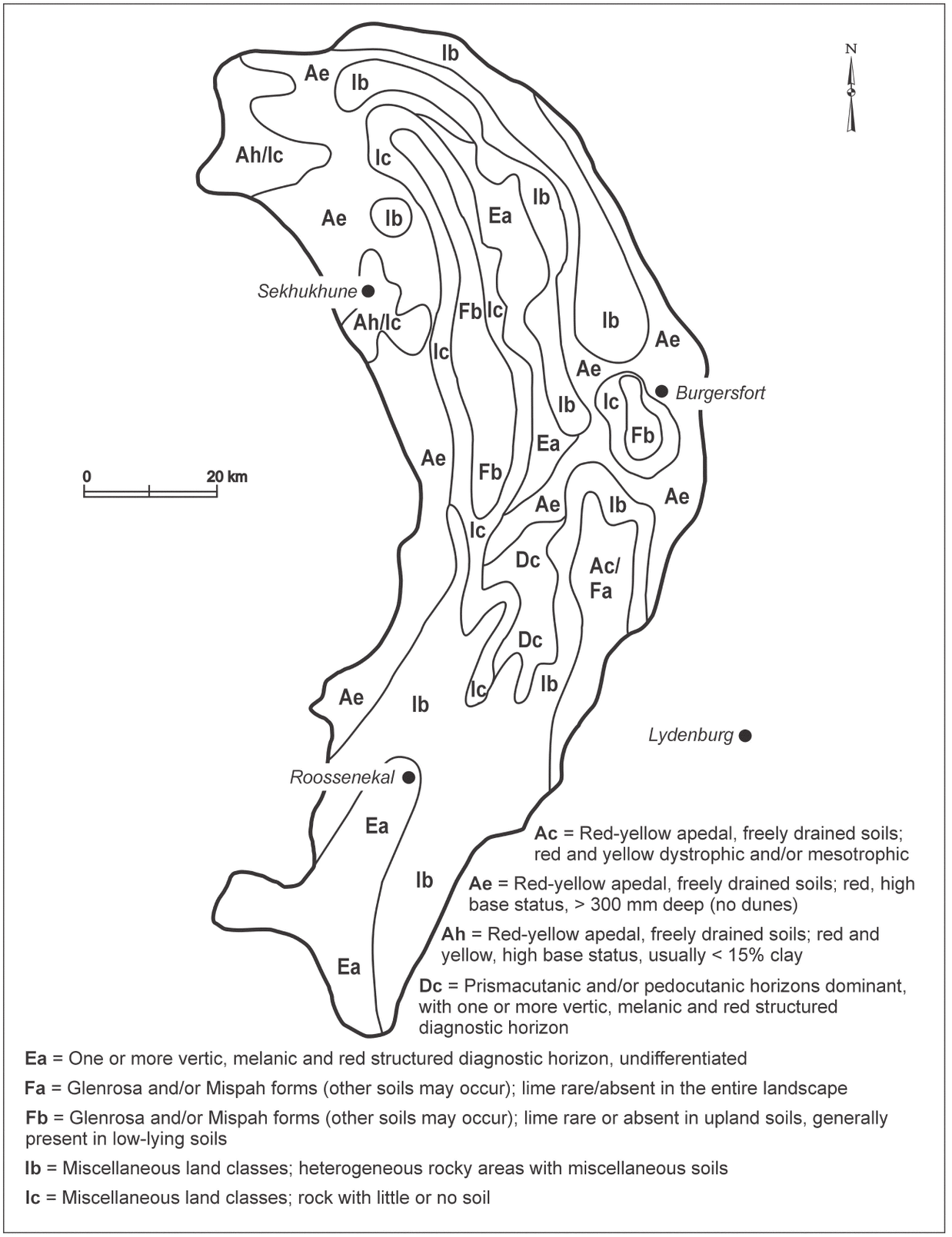


**Figure 3:** Major soil patterns of the Sekhukhuneland Centre of Plant Endemism (based on Land Type Survey Staff (1987, 1988, 1989), MacVicar *et al*. (1991))

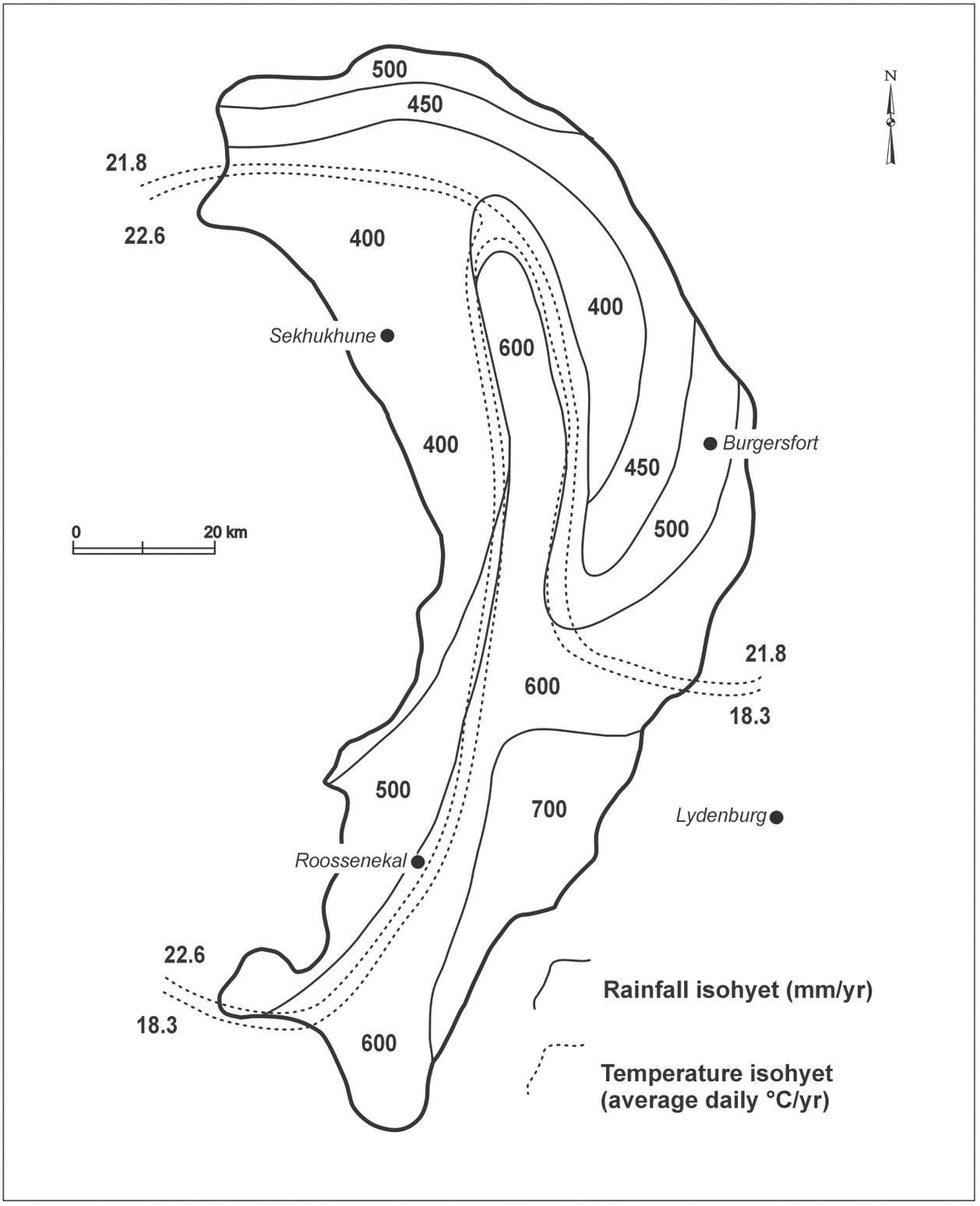


**Figure 4:** Climate of the Sekhukhuneland Centre of Plant Endemism (based on Erasmus (1985), Siebert (1998), Weather Bureau (1998))

specific taxa of the SCPE were determined from relevant literature (Hilton-Taylor 1996, Siebert 1998), fieldwork and herbarium surveys. Taxa of conservation value in each of the identified major vegetation groups are listed in Table 2. The following symbols are used: $ = endemic to the SCPE; # = sub-endemic to the SCPE; E = Endangered; V = Vulnerable; R = Rare; I = Indeterminate; K = Insufficiently Known; N = not threatened in northern provinces of South Africa (threatened in one or more of the other provinces). New IUCN categories are still in the process of being applied or updated for most of these and other taxa (Golding 1999).

## Results

Six major vegetation types were identified (Figure 5), belonging to three major floristic regions in the SCPE (Figure 1). This floristic classification is hierarchical and dependent on scale, with smaller areas accommodated within successively larger ones (McLaughlin 1992).

The first TWINSPAN division separated the azonal wetlands from the other vegetation types. The second division separated the arid northern bushveld from the moister southern and central vegetation types. A further division divided the vegetation into grasslands and woodland/thicket vegetation types. A fourth division divided the bushveld into rock outcrop vegetation, with afromontane elements, and mountain bushveld. Final division of the central mountain bushveld resulted in two types, namely open or closed bushveld.

### *Classification*

The floristic composition of the six major vegetation types is given in the synoptic table (Table 1). The groups are:

1. *Acacia tortilis-Dichrostachys cinerea* Northern Dry Mixed Bushveld;
2. *Kirkia wilmsii-Terminalia prunioides* Closed Mountain Bushveld;
3. *Combretum hereroense-Grewia vernicosa* Open Mountain Bushveld;
4. *Hippobromus pauciflorus-Rhoicissus tridentata* Rock Outcrop Vegetation;
5. *Themeda triandra-Senecio microglossus* Cool Moist Grasslands;
6. *Fuirena pubescens-Schoenoplectus corymbosus* Wetland Vegetation.

Based on the distribution of the plant species within the SCPE in general, the most diagnostic species for each major vegetation type were distinguished, with the most prominent character and differential species then being used for the classification of the groups. However, this remains provisional, for the vegetation of Sekhukhuneland is a complex system due to its heterogeneous habitats. It is difficult to predict the most prominent differential species, for significant variation in species composition arises in any given place and time.

Endemic, sub-endemic and Red Data List species/infraspecific taxa are given for each of the major vegetation types. Forty-four of approximately 50 endemics and 42 of approximately 70 sub-endemics (Siebert 1998) were recorded during the study. Thirty-six taxa were identified as Red Data List taxa (Hilton-Taylor 1996), namely one Endangered, one Vulnerable, eight Rare, one Indeterminate, 15 Insufficiently Known and 10 Threatened in other provinces (not threatened in northern Provinces).

### *Description*

1. *Acacia tortilis-Dichrostachys cinerea* Northern Dry Mixed Bushveld

This vegetation type occurs mostly in the moderately arid and warmer northern part of the study area. It is usually restricted to the deep, clayey alluvium soils of the Olifants and Steelpoort River valleys in the Mixed Bushveld floristic region of the SCPE (Figure 1). It also occurs in the dry river valleys between the mountains of the central parts of the SCPE, where it forms a mosaic with the *Kirkia wilmsii-Terminalia prunioides* Closed Mountain Bushveld.

This bushveld is characteristically a sparse thornveld with an open grassy layer. The tree layer usually reaches a height of approximately 3m. A floristic relationship exists with the vegetation of the Pietersburg Plateau (Bredenkamp and Van Vuuren 1977).

This major vegetation type is climatically induced, more specifically by rainfall, for it is restricted to the region with a maximum average annual rainfall of 400mm (Figure 4). The geology of this region is very heterogeneous (Figure 2) and the soils extremely diverse (Figure 3), and are responsible for heterogeneity within communities.

The diagnostic grasses *Eragrostis barbinodis* and *Tragus berteronianus* are the most important indicator species at the division level separating this bushveld vegetation type from the moister *Kirkia wilmsii-Terminalia prunioides* and the *Combretum hereroense-Grewia vernicosa* Mountain Bushveld types. All diagnostic species of this group are given in species group A (Table 1).

*Acacia tortilis*, *Boscia foetida* subsp. *rehmanniana* and *Dichrostachys cinerea* are the most abundant and prominent dominant tree species of the group. The most frequent occurring diagnostic forbs are *Becium filamentosum*, *Felicia clavipilosa*, *Gisekia africana*, *Hermannia odorata* and *Melhania rehmannii*. Prominent graminoids of the vegetation type include *Aristida congesta*, *Enneapogon cenchroides*, *E. scoparius* and *Urochloa mossambicensis*.

One Rare taxon, *Boscia foetida* subsp. *minima*, and the only recorded Vulnerable taxon for the study area, *Plinthus rehmannii*, occur in this vegetation type (Table 2). Four taxa of conservation value are restricted to this vegetation type and include the succulent sub-endemic, *Huernia stapelioides* (Table 2). This major group has the lowest number of taxa with conservation value of all the zonal vegetation types.

2. *Kirkia wilmsii-Terminalia prunioides* Closed Mountain Bushveld

This mountain bushveld occurs predominantly in the central parts of the SCPE, on clay soils of mountain slopes that are underlain by norite and pyroxenite. The topography is predominantly and typically an undulating landscape. It is the most dominant vegetation type of the Mountain Bushveld

**Table 1:** Synoptic table of the major vegetation types of the Sekhukhuneland Centre of Plant Endemism

| MAJOR GROUP | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| NUMBER OF RELEVES | 47 | 103 | 91 | 100 | 57 | 17 |
| **SPECIES GROUP A** | | | | | | |
| **Diagnostic for the *Acacia tortilis-Dichrostachys cinerea*** | | | | | | |
| *Eragrostis barbinodis* | V | . | . | . | | . |
| *Tragus berteronianus* | IV | . | . | . | | . |
| *Becium filamentosum* | III | . | . | . | | . |
| *Felicia clavipilosa* | III | I | I | . | | . |
| *Gisekia africana* | III | . | I | . | | . |
| *Hermannia odorata* | III | . | . | . | | . |
| *Melhania rehmannii* | III | I | . | . | | . |
| *Phyllanthus maderaspatensis* | III | . | . | . | | . |
| *Urochloa mossambicensis* | III | . | . | I | | . |
| *Acacia mellifera* | II | . | . | . | | . |
| **SPECIES GROUP B** | | | | | | |
| **Diagnostic for the *Kirkia wilmsii-Terminalia prunioides*** | | | | | | |
| *Acacia nigrescens* | . | III | I | . | | . |
| *Clerodendrum ternatum* | . | III | I | . | | . |
| *Commiphora mollis* | . | III | I | . | | . |
| **SPECIES GROUP C** | | | | | | |
| *Acacia tortilis* | IV | II | I | I | I | . |
| *Seddera suffruticosa* | IV | II | I | . | | . |
| *Enneapogon cenchroides* | III | II | I | . | | . |
| *Lantana rugosa* | III | II | I | I | | . |
| *Monechma divaricatum* | III | II | I | . | | . |
| *Boscia albitrunca* | II | III | I | . | | . |
| *Grewia flava* | II | III | I | . | | . |
| *Boscia foetida* subsp. *rehmanniana* | II | II | . | . | | . |
| *Cadaba termitaria* | II | II | . | . | I | . |
| *Rhus engleri* | II | II | I | . | | . |
| **SPECIES GROUP D** | | | | | | |
| **Diagnostic for the *Combretum hereroense-Grewia vernicosa*** | | | | | | |
| *Brachylaena ilicifolia* | . | I | III | . | | . |
| *Orthosiphon fruticosus* | . | I | III | I | | . |
| *Ozoroa sphaerocarpa* | . | I | III | I | | . |
| *Euclea* sp. (S 934) | . | . | II | . | | . |
| *Euphorbia enormis* | . | . | II | . | | . |
| *Jamesbrittenia atropurpurea* | . | . | II | . | | . |
| *Laggera decurrens* | . | . | II | . | | . |
| **SPECIES GROUP E** | | | | | | |
| *Terminalia prunioides* | . | IV | II | . | | . |
| *Psiadia punctulata* | I | III | III | I | | . |
| *Acacia senegal* var. *leiorachis* | I | III | II | . | | . |
| *Aristida canescens* | I | III | II | I | I | I |
| *Barleria saxatilis* | I | III | II | . | . | . |

| MAJOR GROUP | 1 |
|---|---|
| NUMBER OF RELEVES | 47 |
| **SPECIES GROUP F (continued)** | |
| *Balanites maughamii* | II |
| *Blepharis subvolubilis* | II |
| *Geigeria ornativa* | II |
| *Petalidium oblongifolium* | II |
| **SPECIES GROUP G** | |
| **Diagnostic for the *Hippobromus pauciflorus*** | |
| *Aristida transvaalensis* | . |
| *Cyphostemma woodii* | . |
| *Gerbera jamesonii* | . |
| *Maytenus undata* | . |
| *Allophylus africanus* | . |
| *Diospyros whyteana* | . |
| *Grewia occidentalis* | . |
| *Olea capensis* | . |
| *Orthosiphon labiatus* | . |
| *Tetradenia brevispicata* | . |
| **SPECIES GROUP H** | |
| *Diospyros lycioides* subsp. *nitens* | . |
| *Acacia ataxacantha* | . |
| *Combretum molle* | . |
| *Cymbopogon excavatus* | . |
| *Xerophyta retinervis* | . |
| *Catha transvaalensis* | . |
| *Mimusops zeyheri* | . |
| *Pavetta zeyheri* | . |
| **SPECIES GROUP I** | |
| *Kirkia wilmsii* | . |
| *Panicum deustum* | . |
| *Asparagus laricinus* | . |
| *Elephantorrhiza praetermissa* | . |
| *Hippobromus pauciflorus* | . |
| *Ziziphus mucronata* | I |
| *Aloe cryptopoda* | . |
| *Croton gratissimus* | I |
| *Dombeya rotundifolia* | . |
| *Jasminum multipartitum* | . |
| **SPECIES GROUP J** | |
| *Aloe marlothii* | . |
| *Celtis africana* | . |
| *Clerodendrum glabrum* | . |
| *Euphorbia ingens* | . |
| *Grewia monticola* | . |

Table 1 cont.

| MAJOR GROUP | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| NUMBER OF RELEVES | 47 | 103 | 91 | 100 | 57 | 17 |
| **SPECIES GROUP L** | | | | | | |
| **Diagnostic for the *Themeda riandra-Senecio microglossus*** | | | | | | |
| *Acalypha punctata* | . | . | . | I | III | . |
| *Clerodendrum triphyllum* | . | . | . | . | III | . |
| *Thesium gracilentum* | . | . | . | . | III | . |
| *Cephalaria zeyheriana* | . | . | . | . | I | . |
| *Dicoma zeyheri* | . | . | . | . | I | . |
| *Elephantorrhiza elephantina* | . | . | . | . | I | . |
| *Hermannia antonii* | . | . | . | . | I | . |
| *Melhania randii* | . | . | . | . | I | . |
| *Protea caffra* | . | . | . | . | I | . |
| *Vernonia oligocephala* | . | . | . | . | I | . |
| **SPECIES GROUP M** | | | | | | |
| *Hypoxis rigidula* | . | . | I | II | V | . |
| *Aloe greatheadii* | . | I | I | II | III | . |
| *Eragrostis nindensis* | I | I | I | II | III | I |
| *Ledebouria revoluta* | . | I | I | II | III | . |
| *Convolvulus sagittatus* | . | . | . | II | I | . |
| *Jasminum quinatum* | . | . | . | II | I | . |
| *Lopholaena coriifolia* | . | . | I | II | I | . |
| *Cyphostemma* sp. A (W 13389) | . | . | I | II | I | . |
| *Pearsonia sessilifolia* | . | . | . | II | I | . |
| *Senecio macrocephalus* | . | . | . | II | I | . |
| **SPECIES GROUP N** | | | | | | |
| *Vitex obovata* subsp. *wilmsii* | . | I | IV | III | IV | . |
| *Euclea crispa* | . | I | III | III | I | . |
| *Rhoicissus tridentata* | . | I | II | IV | I | . |
| *Cussonia transvaalensis* | . | I | II | III | I | . |
| *Senecio latifolius* | . | . | II | II | IV | . |
| *Rhynchosia spectabilis* | . | . | II | II | III | . |
| *Setaria sphacelata* | . | I | II | II | III | . |
| *Acacia caffra* | . | I | II | II | I | . |
| *Eragrostis chloromelas* | . | I | II | II | I | . |
| *Tristachya leucothrix* | . | . | II | II | I | I |
| **SPECIES GROUP O** | | | | | | |
| *Diheteropogon amplectens* | . | I | II | I | IV | . |
| *Berkheya insignis* | . | . | II | I | III | . |
| *Brachiaria serrata* | . | I | II | I | III | . |

| MAJOR GROUP | 1 |
|---|---|
| NUMBER OF RELEVES | 47 |
| **SPECIES GROUP P (continued)** | |
| *Indigofera hilaris* | . |
| *Raphionacme galpinii* | . |
| *Andropogon schirensis* | . |
| *Melhania prostrata* | . |
| *Melinis nerviglumis* | . |
| *Tephrosia purpurea* | . |
| **SPECIES GROUP Q** | |
| *Aristida congesta* | V |
| *Aristida adscensionis* | III |
| *Panicum maximum* | III |
| *Asparagus suaveolens* | II |
| *Cynodon dactylon* | II |
| *Kedrostis foetidissima* | II |
| *Pollichia campestris* | II |
| *Polygala hottentotta* | II |
| *Ruellia patula* | II |
| *Seddera capensis* | II |
| **SPECIES GROUP R** | |
| **Diagnostic for the *Fuirena pubescens-Schoe*** | |
| *Fuirena pubescens* | . |
| *Andropogon eucomus* | . |
| *Artemisia afra* | . |
| *Schoenoplectus corymbosus* | . |
| *Chironia purpurascens* | . |
| *Conyza scabrida* | . |
| *Fimbristylis ferruginea* | . |
| *Imperata cylindrica* | . |
| *Miscanthus junceus* | . |
| *Phragmites australis* | . |
| *Salix mucronata* | . |
| **SPECIES GROUP S** | |
| *Senecio microglossus* | . |
| *Cymbopogon validus* | . |
| *Hyparrhenia filipendula* | . |
| *Aristida bipartita* | . |
| *Lippia javanica* | . |
| *Lippia rehmannii* | . |

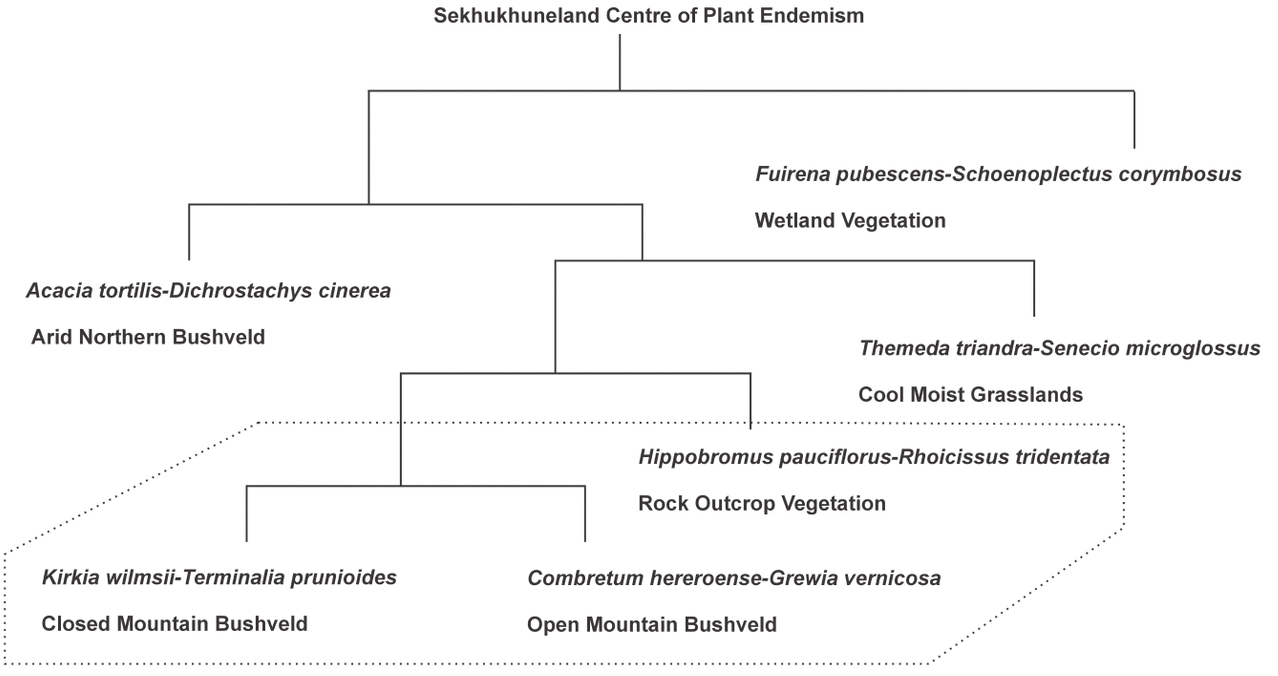


**Figure 5:** Dendrogram depicting the TWINSPAN division of the six major vegetation types of the Sekhukhuneland Centre of Plant Endemism. The dotted line encompasses the vegetation types which are seen as part of the proposed *Kirkia wilmsii-Acacia caffra* Alliance on nutrient-rich clay soils

floristic region (Figure 1).

The grass layer of this open bushveld is well developed and the tree layer varies between 2–5m. A mosaic is formed with the *Acacia tortilis-Dichrostachys cinerea* Northern Dry Mixed Bushveld on clays of the dry valleys and the *Combretum hereroense-Grewia vernicosa* Open Mountain Bushveld on anomalous soils of mountain footslopes.

This major group is a product of the regions topography (Figure 1), soils (Figure 3) and climate (Figure 4). The relatively drier, warmer climate facilitated the development of bushveld instead of grassland on the hills. An undulating topography separates this bushveld group from the lowland microphyllous thornveld. Soil patterns were responsible for the division between closed Mountain Bushveld on widespread soils and open Mountain Bushveld on 'toxic' soils.

The indicator species for this vegetation type are *Dichrostachys cinerea* and *Panicum deustum*. These species are the most important taxa in the group's separation from the other related major groups. Plant species of diagnostic value in this vegetation type are listed in species group B (Table 1).

The *Kirkia wilmsii-Terminalia prunioides* Closed Mountain Bushveld is characterised by the diagnostic trees *Acacia nigrescens* and *Commiphora mollis*, and the dominant trees/shrubs *Acacia senegal* var. *leiorachis*, *Combretum apiculatum*, *Kirkia wilmsii* and *Terminalia prunioides*. Conspicuous dominant forbs are the diagnostic *Clerodendrum ternatum*, and the prominent *Barleria saxatilis*, *Psiadia punctulata* and *Sansevieria hyacinthoides*. Prominent, abundant grass species include *Aristida canescens*, *Enneapogon scoparius*, *Heteropogon contortus* and *Panicum deustum*.

This major group has the second highest number of SCPE endemics (Table 2). Eleven Red Data List taxa were also recorded, with the four taxa categorised as Rare, being the highest number for a major group (Table 2). Eight taxa of conservation importance are restricted to this group, of which the endemic, *Plectranthus venteri*, and sub-endemic, *Ledebouria dolomiticola*, are examples (Table 2).

3. *Combretum hereroense-Grewia vernicosa* Open Mountain Bushveld

This sparse open bushveld has a patchy distribution throughout the whole study area. It occurs on anomalous soils that contain high concentrations of heavy metals (Al, Cr, Fe, Ni, Pt, Ti and V) and high levels of Mg and Ca. These soils have a weak structure and high erosion potential.

This sparse bushveld, with a scattered grass sward, gives way to the *Acacia tortilis-Dichrostachys cinerea* Northern Dry Mixed Bushveld (a deciduous microphyllous thornveld) in the north and *Kirkia wilmsii-Terminalia prunioides* Closed Mountain Bushveld (a deciduous broad-leaved savanna) in the central parts. To a lesser extent it also occurs as patches in the *Themeda triandra-Senecio microglossus* Cool Moist Grasslands. Thus an extensive mosaic is formed. It is, however, more predominant in the Mountain Bushveld floristic region (Figure 1).

The existence of this vegetation type can primarily be ascribed to geology (Figure 2) and soils (Figure 3). Aridity, induced by freely drained or vertic soils, and metalliferous soils, produced by specific layers of the Rustenburg Layered

**Table 2:** Endemic, sub-endemic and Red Data List taxa recorded for each of the major vegetation types (symbols explained under 'methods' in text)

| Vegetation type | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| Number of relevés | 47 | 103 | 91 | 100 | 57 | 17 |
| *Albuca* sp. (S 856) | $ | $ | $ | . | . | . |
| *Polygala* sp. (S 449) | $ | . | $ | . | $ | . |
| *Gnidia caffra* [form] (W & S 12975) | . | $ | $ | $ | $ | . |
| *Xerophyta retinervis* [form] (W & S 13208) | . | $ | $ | $ | $ | . |
| *Elephantorrhiza praetermissa* | . | $K | $K | $K | $K | . |
| *Bauhinia tomentosa* [form] (S 444) | . | $ | $ | $ | . | . |
| *Catha transvaalensis* | . | $ | $ | $ | . | . |
| *Gymnosporia* sp. (S 458) | . | $ | $ | $ | . | . |
| *Orthosiphon fruticosus* | . | $ | $ | $ | . | . |
| *Rhoicissus sekhukhuniensis* | . | $ | $ | $ | . | . |
| *Asparagus sekhukhuniensis* | . | $K | . | $K | . | . |
| *Aloe burgersfortensis* | . | $ | $ | . | . | . |
| *Euphorbia* sp. (W 13194) | . | $ | $ | . | . | . |
| *Stylochaeton* sp. (S 672) | . | $ | $ | . | . | . |
| *Hibiscus barnardii* | . | $R | $R | . | . | . |
| *Rhus batophylla* | . | $R | $R | . | . | . |
| *Asparagus intricatus* [form] (W & S 1358) | . | $ | . | $ | . | . |
| *Cyphostemma* sp. B (S 1383) | . | $ | . | $ | . | . |
| *Hemizygia* sp. (S 615) | . | $ | . | $ | . | . |
| *Kleinia longiflora* [form] (W & S 13239) | . | $ | . | $ | . | . |
| *Premna mooiensis* [form] (W & S 13004) | . | $ | . | $ | . | . |
| *Stylochaeton* sp. nov. (S 1332) | . | $ | . | $ | . | . |
| *Ledebouria dolomiticola* | . | $ | . | . | . | . |
| *Plectranthus venteri* | . | $ | . | . | . | . |
| *Tragia* sp. (S 1573) | . | $ | . | . | . | . |
| *Berkheya insignis* [form] (S 257) | . | . | $ | $ | $ | . |
| *Cyphostemma* sp. A (W 13389) | . | . | $ | $ | $ | . |
| *Pavetta zeyheri* [form] (S 22) | . | . | $ | $ | . | . |
| *Rhus sekhukhuniensis* | . | . | $R | $R | . | . |
| *Asclepias* sp. (S 27) | . | . | $ | . | $ | . |
| *Ipomoea bathycolpos* var. | . | . | $ | . | $ | . |
| *Jamesbrittenia macrantha* | . | . | $K | . | $K | . |
| *Euclea* sp. nov. (S 934) | . | . | $ | . | . | . |
| *Jamesbrittenia* sp. (W 13026) | . | . | $ | . | . | . |
| *Euphorbia barnardii* | . | . | $E | . | . | . |
| *Rhoicissus* sp. (S 48) | . | . | . | $ | $ | . |
| *Euphorbia sekukuniensis* | . | . | . | $R | . | . |
| *Acacia karroo* [form] (P 4) | . | . | . | . | $ | $ |
| *Cyphostemma* sp. C (D 4142) | . | . | . | . | $ | . |
| *Tulbaghia* sp. nov. (S 1304) | . | . | . | . | $ | . |
| *Protea caffra* subsp. *caffra* [form] (S 1382) | . | . | . | . | $ | . |
| *Schizoglossum* sp. (S 628) | . | . | . | . | $ | . |
| *Zantedeschia jucunda* | . | . | . | . | $ | . |
| *Melhania randii* [form] (S 46) | . | . | . | . | $K | . |
| *Aloe castanea* | # | # | # | # | # | . |
| *Grewia vernicosa* | # | # | # | . | . | . |
| *Petalidium oblongifolium* | # | # | # | . | . | . |
| *Rhus engleri* | # | # | # | . | . | . |
| *Boscia albitrunca* var. '*macrophylla* | # | # | . | . | . | . |
| *Dombeya autumnalis* | # | . | . | . | . | . |
| *Huernia stapelioides* | # | . | . | . | . | . |
| *Plinthus rehmannii* | #V | . | . | . | . | . |
| *Triaspis glaucophylla* | . | # | # | # | # | . |
| *Vitex obovata* subsp. *wilmsii* | . | # | # | # | # | . |
| *Jatropha latifolia* var. *latifolia* | . | # | # | # | . | . |
| *Kleinia stapeliiformis* | . | # | # | # | . | . |
| *Plectranthus xerophilus* | . | # | # | # | . | . |
| *Euclea linearis* [form] (S 937) | . | # | # | . | # | . |
| *Brachylaena ilicifolia* [form] (S 613) | . | # | # | . | . | . |

| Vegetation type | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| Number of releves | 47 | 103 | 91 | 100 | 57 | 17 |
| *Combretum petrophilum* | . | #R | #R | . | . | . |
| *Aloe fosterii* | . | # | . | # | . | . |
| *Asparagus clareae* | . | #K | . | #K | . | . |
| *Dicliptera fruticosa* | . | # | . | . | . | . |
| *Orthosiphon tubiformis* | . | # | . | . | . | . |
| *Rhus wilmsii* | . | . | #K | #K | #K | . |
| *Argyrolobium wilmsii* | . | . | # | . | # | . |
| *Helichrysum uninervium* | . | . | # | . | # | . |
| *Rhus keetii* | . | . | # | . | # | . |
| *Nuxia gracilis* | . | . | #K | . | . | #K |
| *Euphorbia enormis* | . | . | # | . | . | . |
| *Ozoroa albicans* | . | . | #K | . | . | . |
| *Jasminum quinatum* | . | . | . | # | # | . |
| *Rhus tumulicola* var. *meeuseana* | . | . | . | # | # | . |
| *Anthericum cyperaceum* | . | . | . | # | . | . |
| *Clerodendrum suffruticosum* [form] (S | . | . | . | # | . | . |
| *Dyschoriste perrotteti* | . | . | . | # | . | . |
| *Euphorbia lydenburgensis* | . | . | . | # | . | . |
| *Gymnosporia* sp. nov. (W & S 13351) | . | . | . | # | . | . |
| *Huernia insigniflora* | . | . | . | # | . | . |
| *Nemesia zimbabwensis* | . | . | . | # | . | . |
| *Aloe reitzii* var. *reitzii* | . | . | . | #I | . | . |
| *Adenia wilmsii* | . | . | . | #K | . | . |
| *Tulbaghia coddii* | . | . | . | #K | . | . |
| *Zantedeschia pentlandii* | . | . | . | #R | #R | . |
| *Aneilema longirrhizum* | . | . | . | . | # | . |
| *Hermannia antonii* | . | . | . | . | # | . |
| *Gossypium herbaceum* subsp. | N | N | . | . | . | . |
| *Boscia foetida* subsp. *minima* | R | R | . | . | . | . |
| *Pegolettia senegalensis* | N | . | . | . | . | . |
| *Mosdenia leptostachys* | . | K | . | . | . | . |
| *Pachypodium saundersii* | . | N | . | . | . | . |
| *Stapelia gigantea* | . | N | . | . | . | . |
| *Scilla natalensis* | . | . | N | N | N | . |
| *Pavetta zeyheri* | . | . | N | N | . | . |
| *Rhus rogersii* | . | . | . | N | N | . |
| *Eucomis autumnalis* subsp. *clavata* | . | . | . | . | N | N |
| *Disa rhodantha* | . | . | . | . | K | . |
| *Rhynchosia nitens* | . | . | . | . | K | . |
| *Thesium gracilentum* | . | . | . | . | K | . |
| *Tristachya biseriata* | . | . | . | . | K | . |
| *Callilepis leptophylla* | . | . | . | . | N | . |
| *Jamesbrittenia silenoides* | . | . | . | . | N | . |
| *Eucomis montana* | . | . | . | . | R | . |
| Endemics ($) | 2 | 24 | 25 | 21 | 17 | 1 |
| Sub-endemics (#) | 8 | 17 | 19 | 22 | 13 | 1 |
| Endangered (E) | . | . | 1 | . | . | . |
| Vulnerable (V) | 1 | . | . | . | . | . |
| Rare (R) | 1 | 4 | 4 | 3 | 2 | . |
| Indeterminate (I) | . | . | . | 1 | . | . |
| Insufficiently Known (K) | . | 4 | 5 | 6 | 8 | 1 |
| Threatened in other regions of s. Afr. | 2 | 3 | 2 | 3 | 5 | 1 |
| Red Data List Taxa | 4 | 11 | 12 | 13 | 15 | 2 |
| TOTAL | 13 | 46 | 46 | 46 | 40 | 3 |
| Restricted to vegetation type | 4 | 8 | 5 | 11 | 15 | 0 |

D= G Dednam; P= PP Swartz; S= SJ Siebert; W= AE van Wyk
sp. = possibly an undescribed species
sp. nov. = presently being formally described as a new species

Suite, have created harsh environments. These open niches have been filled by a specific group of plant species, which are common in other major groups as well. This vegetation type can be described as an anomaly, for the species composition and predominantly stunted structure is very distinctive and different from the surrounding vegetation.

*Combretum hereroense* and *Loudetia simplex* were identified as the indicator species that separate this vegetation type from the other bushveld types. Diagnostic plant species for this vegetation type are listed in species group D (Table 1).

Small trees/shrubs, which are diagnostic, are *Brachylaena ilicifolia* and *Ozoroa sphaerocarpa.* Prominent and abundant woody species include *Combretum hereroense*, *Grewia vernicosa*, *Tinnea rhodesiana* and *Vitex obovata* subsp. *wilmsii*. Forbs such as the diagnostic *Euphorbia enormis* and *Orthosiphon fruticosus*, and prominent *Commelina africana*, *Kyphocarpa angustifolia* and *Phyllanthus glaucophyllus,* occur frequently. *Enneapogon scoparius*, *Heteropogon contortus* and *Themeda triandra* are the dominant grasses of the vegetation type.

This is the major vegetation type with the most SCPE endemics recorded within it (Table 2). Together with the Closed Mountain Bushveld it is host to four Rare taxa, the most for any group. The only Endangered taxon in the study area, *Euphorbia barnardii*, occurs in this major group (Table 2).

4. *Hippobromus pauciflorus-Rhoicissus tridentata* Rock Outcrop Vegetation

The communities of the *Hippobromus pauciflorus-Rhoicissus tridentata* Rock Outcrop Vegetation are scattered as bushclumps, or stages of it, throughout the study area, but are more frequent in the southern region. It prefers sheltered habitats of rock outcrops, ridges, flats and boulders.

The vegetation type can be found within all the floristic regions of the Centre (Figure 1), but to a lesser degree in the Mixed Bushveld floristic region. These broad-leaved closed woodlands or open shrublands of rock outcrops have a strong floristic link with afromontane vegetation. Two patches of afromontane forest, both from the Leolo Mountains, are included in this group. The tree layer is mostly 5m, but heights of up to 10m have also been recorded.

On a macro scale, the vegetation of rocky outcrops is dependent on topography (Figure 1). However, this vegetation type, although not diverse, is very specialised and a direct consequence of specific environmental conditions (Bredenkamp and Deutschländer 1995).

The indicator species that delimitate this vegetation type are *Celtis africana* and *Aloe arborescens*. Diagnostic species of this rock outcrop vegetation type are listed in species group G (Table 1).

Prominent tree/shrub species, representative of all four types of rock habitats are the diagnostic *Maytenus undata* and the woody species *Acacia ataxacantha*, *Aloe castanea*, *Combretum molle*, *Cussonia transvaalensis*, *Hippobromus pauciflorus* and *Rhoicissus tridentata*. The most abundant forbs include the diagnostic taxa *Cyphostemma woodii*, *Gerbera jamesonii*, *Orthosiphon labiatus* and *Tetradenia brevispicata*. *Xerophyta retinervis* is also prominent in the group. Dominant grasses are the diagnostic *Aristida transvaalensis* and abundant *Cymbopogon excavatus*.

This vegetation type has the status as the major group with the highest number of SCPE sub-endemic taxa (Table 2). The second highest number of Red Data List taxa is also present, including the only Indeterminate taxon recorded for the whole study area, *Aloe reitzii* var. *reitzii* (Table 2). Eleven taxa of conservation importance, the second highest number for the SCPE, are restricted to this group, of which *Adenia wilmsii*, *Euphorbia sekhukhuniensis* and *Tulbaghia coddii* are of conservation priority (Table 2).

5. *Themeda triandra-Senecio microglossus* Cool Moist Grasslands

This grassland is restricted to the higher altitude undulating hills of the southern region, and to a lesser degree, the high altitude plateau of the Leolo Mountains in the central region. It occurs on shallow clay soils underlain by norite and exhibits the highest floristic diversity in the region.

The vegetation is dense grassland, with scattered woody species. A floristic link exists with the grasslands of the Steenkampsberg (Burgoyne 1995). This vegetation type is predominant in the Grassland floristic region (Figure 1).

High altitudes (Figure 1), temperate climates with high rainfall and frost (Figure 4), and seasonal fires give rise to grasslands in the SCPE. This vegetation type follows the 600mm and 18°C isohyet, and is maintained, not created, by the seasonal fires (Van Oudtshoorn 1999) that occur in different areas of Sekhukhuneland annually.

The most important indicator species for the division between the bushveld and the grassland are *Diheteropogon amplectens* and *Senecio microglossus*. Diagnostic taxa for this group are presented in species group L (Table 1).

Diagnostic woody species in this region include the tree, *Protea caffra,* and the suffrutex, *Elephantorrhiza elephantina*. The invasive alien tree, *Acacia dealbata*, is a problem in this vegetation type. Many prominent forbs occur frequently in this major group and include the diagnostic *Acalypha punctata*, *Clerodendrum triphyllum* and *Thesium gracilentum*, and the abundant *Berkheya insignis*, *Gnidia caffra*, *Hypoxis rigidula*, *Senecio latifolius* and *S. microglossus*. This vegetation type is characterised by the dominance of graminoids, which include prominent, conspicuous grasses such as *Brachiaria serrata*, *Diheteropogon amplectens*, *Elionurus muticus*, *Setaria sphacelata*, *Themeda triandra* and *Tristachya leucothrix*.

The highest number of Red Data List taxa, namely 15, occurs in this vegetation type (Table 2). Of these taxa two are Rare, eight are Insufficiently Known (highest number for the study area) and five are threatened elsewhere in southern Africa (Table 2). This major group also has the highest number of taxa with conservation importance restricted to a vegetation type in the study area, and includes taxa such as the endemic *Zantedeschia jucunda* and the Rare *Eucomis montana* (Table 2).

6. *Fuirena pubescens-Schoenoplectus corymbosus* Wetland Vegetation

This wetland vegetation is found throughout the region, on

stream banks in the valleys, seepage areas on the mountain slopes and wetlands on the mountain plateaux. It is usually associated with vertic black clay soils that are saturated with water during the spring, summer and autumn seasons.

A floristic affinity exists with the *Themeda triandra-Senecio microglossus* Cool Moist Grassland. It is also an extension of the wetlands on the Steenkampsberg (Bloem 1988). This vegetation type is found throughout the Centre in all the floristic regions (Figure 1), especially in the grassland. It has, however, not been investigated thoroughly during this study.

This vegetation type is not bound by climate, geology, soils or topography, but is only dependent on a permanent water supply for the largest part of the year. Hence, many of the taxa in this major group are widespread throughout the northern provinces of South Africa.

*Fuirena pubescens* and *Schoenoplectus corymbosus* are the indicator species separating this azonal vegetation type from the zonal. Diagnostic species for this group are presented in species group R (Table 1).

*Salix mucronata* is the diagnostic woody species for the group. Herbs are plentiful, with *Artemisia afra*, *Conyza scabrida* and *Chironia purpurascens* the diagnostic forbs and *Fimbristylis ferruginea*, *Fuirena pubescens* and *Schoenoplectus corymbosus* the diagnostic sedges. Frequently occurring, diagnostic taxa of the Poaceae include *Andropogon eucomis*, *Imperata cylindrica*, *Miscanthus junceus* and *Phragmites australis*, and other dominant grasses are *Cymbopogon validus* and *Hyparrhenia filipendula*.

This vegetation type has the lowest number of taxa of conservation value (Table 2). However, this is a northeastern Drakensberg Escarpment wetland system, which means that it should receive conservation priority (Bloem 1988, Burgoyne 1995). One endemic taxon, a form of *Acacia karroo*, one sub-endemic which is Insufficiently Known in the Red Data List, *Nuxia gracilis*, and one Red Data List taxon not threatened in the northern provinces, *Eucomis autumnalis* subsp. *clavata*, occur in this vegetation type (Table 2).

## Discussion

This is the very first attempt to classify vegetation types based on relevé data for the Sekhukhuneland Centre of Plant Endemism. At this stage the formal names of these vegetation types, which represent higher syntaxa (probably at the order or alliance level), cannot be validly described according to the Code for Phytosociological Nomenclature (Barkman *et al.* 1986), as formal descriptions of the associations are not yet published.

The vegetation of the study area is very diverse, comprising communities and species from three of South Africa's biomes, namely savanna, grassland and forest. This phenomenon is supported by the theory that local diversity and community patterns are strongly influenced on temporal and spatial scales by regional processes such as immigration (Loreau and Mouquet 1999) and changes in rainfall, soil nutrient content, fire regime and herbivory (Skarpe 1991).

Typical savanna (bushveld) plant species include *Dichrostachys cinerea*, *Enneapogon scoparius* and *Evolvulus alsinoides*; typical grassland plant species include *Acalypha punctata*, *Clerodendrum triphyllum* and *Thesium gracilentum*; typical forest plant species include *Maytenus undata*, *Allophylus africanus* and *Apodytes dimidiata*. A floristic link exist with the Northern Cape and Northwest Province (arid part of Savanna Biome), with shared taxa such as *Gnidia polycephala*, *Nuxia gracilis*, *Pterothrix spinescens*, *Rhigozum obovatum* and *Stipagrostis hirtugluma* subsp. *patula*.

Destruction of plant communities in the SCPE can drive certain plant species to local extinction due to the smaller range size and moderate to low local abundance. This is in accordance with the hypotheses on the relationship between distribution and abundance (Johnson 1998). Future papers will highlight various unique plant communities and their habitat specific plant species within the broad vegetation types of the SCPE, several of which are of conservation value. The phytodiversity of the SCPE is enhanced by the complex topography and geology of the region, a sharp climatic gradient from northwest to southeast and specifically adapted plant endemics (Siebert 1998). The following conclusions can be drawn from the classification of the zonal vegetation in the SCPE:

- *Acacia tortilis-Dichrostachys cinerea* Northern Dry Mixed Bushveld should be seen as part of the proposed class of *Panico maximi-Acacietea tortilis* (Winterbach *et al.* 2000) — it also has a link with the lowveld of South Africa in the form of tree species such as *Ptaeroxylon obliquum*, *Lonchocarpus capassa*, *Diospyros mespiliformis* and *Combretum imberbe*.
- *Themeda triandra-Senecio microglossus* Cool Moist Grassland is representative of the *Tristachya leucothrix-Trachypogon spicatus* Class as proposed by Du Preez and Bredenkamp (1991) — however, in this case it might be considered as an ecotone between highveld grassland and mountain bushveld.
- Currently the *Kirkia wilmsii-Terminalia prunioides*, *Combretum hereroense-Grewia vernicosa* and *Hippobromus pauciflorus-Rhoicissus tridentata* vegetation types are considered as part of the proposed class of *Englerophytum magalismontanum-Acacia caffra* Mountain Bushveld (Winterbach *et al.* 2000). However, this class does not consider the entire range of mountain bushveld types on clay and sandy soils of South Africa. A more inclusive *Acacia caffra* Mountain Bushveld Class is proposed, with an *Englerophytum magalismontanum-Acacia caffra* order on nutrient-poor sandy soils and a *Kirkia wilmsii-Acacia caffra* Alliance on nutrient-rich clay soils.

The proposed *Kirkia wilmsii-Acacia caffra* order (Figure 5) is representative of Sekhukhuneland. Diagnostic species for this order would be *Aloe burgersfortensis*, *Asparagus sekhukhuniensis*, *Catha transvaalensis*, *Cyphostemma* sp. nov. (Van Wyk 13389), *Elephantorrhiza praetermissa*, *Euphorbia sekukuniensis*, *Hibiscus barnardii*, *Jamesbrittenia macrantha*, *Plectranthus venterii*, *Rhoicissus sekhukhuniensis*, *Rhus batophylla*, *Rhus sekhukhuniensis*, *Stylochiton* sp. nov. (Siebert 1332), *Vitex obovata* subsp. *wilmsii* and *Zantedeschia pentlandii* (species groups B, D, E, G, H, I and J).

- The SCPE is an important area for the protection of taxa with conservation value along the northeastern Drakensberg

Escarpment, especially the plant communities of the *Themeda triandra-Senecio microglossus* Cool Moist Grassland and the *Hippobromus pauciflorus-Rhoicissus tridentata* Rock Outcrop Vegetation.

• Major vegetation types in the Sekhukhuneland Centre of Plant Endemism is a direct consequence of the topography, geology, soils and climate in which the endemics of the region has evolved.

Further work should attempt to combine into a single database the relevés of this study and those of Van der Meulen (1979) which were sampled on gabbro, norite, pyroxenite and allied rocks (such as anorthosite) of the western Rustenburg Layered Suite. A phytosociological synthesis of data acquired from the vegetation of the entire Rustenburg Layered Suite will improve our knowledge of the processes that gave rise to the SCPE flora and plant communities. Data can also be included into a phytosociological classification for all the serpentine-related ultramafic rocks of the Bushveld Complex; this will contribute towards a better understanding of the plant community ecology of the unique vegetation types on ultramafic rock.

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